

REMARKS

This is in response to the Office Action mailed on July 29, 2003. Pending in the present application were claims 21-40, all of which have been rejected as failing to comply with the written description requirement and as being anticipated by the prior art. Additionally, the specification was objected to as failing to provide proper antecedent basis for the claimed subject matter. With this Amendment, claims 21, 26-29, 32, and 35-37 are amended. Pending claims 21-40 are now in condition for allowance and reconsideration and notice to that effect is respectfully requested.

Paragraph 5 – Written Description

In paragraph 5 of the Office Action, claims 21-40 were rejected under 35 U.S.C. § 112, ¶ 1, as failing to comply with the written description requirement regarding reference made in each of the independent claims to "an uneven growing film topography" and to "each of the plurality of layers that is deposited on the growing film topography having ballistic separation of deposited components." Although claims 21-40 have been amended to better define the claimed invention, claims 21-40 still refer to an "uneven film topography" and a "ballistic separation" of deposited components. Contrary to the unsubstantiated allegations in the Office Action, the written description as originally presented provides adequate support for this language.

Section 2163 of the M.P.E.P. instructs that the "examiner has the initial burden, after a thorough reading and evaluation of the content of the application, of presenting evidence or reasons why a person skilled in the art would not recognize that the written description of the invention provides support for the claims." The M.P.E.P. further states that "there is a strong presumption that an adequate written description of the claimed invention is present in the specification as filed." See *In re Wertheim*, 541 F.2d 257, 263 (CCPA 1976)). While Applicant admits that the specification does not recite the invention in exactly the same terms as it is claimed, the specification does provide adequate support for the claimed invention. Moreover, no *in haec verba* requirement exists when adding new claims. See, M.P.E.P. § 2163.

As evidenced by the following excerpts, the written description as originally presented provides more than adequate support for the claimed invention:

The present invention is an anisotropic thin film structure having lateral composition modulations which cause the thin film structure to exhibit anisotropic properties. Such a thin film structure can be built by depositing at least two separate components at differing deposition angles, deposition directions and/or deposition rates.

These composition variations, or modulations, result from a **natural roughness of a growing film surface**. During deposition of a thin film structure, **a top surface of the structure will not grow evenly**; that is, mounds and valleys in the top surface will form. Thus, if two distinct components A and B were simultaneously deposited at respective opposing directions east and west, then an eastern side of the mounds would tend to collect more atoms of component A than atoms of component B. Similarly, a western side of the mounds would tend to collect more atoms of component B than atoms of component A. **Thus, a ballistic separation of components A and B takes place, a signature of which is created in a growing surface morphology of the thin film structure's composition.**

(Page 3, line 20 - page 4, line 6)(emphasis added). The application uses similar language in describing the computer simulated thin film structures of FIGS. 1 and 2 as follows:

After a single atomic layer has been deposited, portions of the substrate are left uncovered by components A and B. (FIGS. 1A and 2A). Once the thin film structure is built up to three atomic layers, **an unevenness of a top surface of the thin film structure has grown more pronounced** as mounds and valleys in the top surface begin taking shape and cause the ballistic separation of components A and B. (FIGS. 1B and 2B). As the thin film structure is continued to be built, atoms of components A and B will tend to collect on opposite sides of the mounds, thereby resulting in a lateral composition modulation in the thin film structure. **Once the thin film structure is built up to ten atomic layers, the ballistic separation of components A and B is well defined.** (FIGS. 1C and 2C). Finally, when the thin film structure has been built up to twenty atomic layers, the anisotropy of the thin film structure's composition is clearly visible as substantially lateral stripes of components A and

B are formed in a direction substantially normal to the direction at which components A and B are deposited. (FIGS. 1D and 2D).

(Page 5, lines 1-14) (emphasis added). Thus, the terms "uneven film topography" and a "ballistic separation" of deposited components are supported by the written description, and this rejection should be withdrawn.

Paragraph 8 – Indefiniteness

In paragraph 8 of the Office Action, claims 21-40 were rejected under 35 U.S.C. § 112, ¶ 2, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Paragraphs 9-17 detail the grounds, each of which is addressed below, by which claims 21-40 are rejected.

The Office Action specified that the terms "direction" of independent claims 21, 27, and 35 and "deposition angle" of claim 35 were indefinite. These claims have now been amended to explicitly specify that each component is deposited from a "deposition direction" measured in a plane of the thin film structure. Consistent with claims 21 and 27, claim 35 has also been amended to specify that it is the "deposition angle", and not the "direction, that is measured from a vertical line substantially normal to the plane of the thin film structure. These definitions are consistent with standard oblique deposition terminology, and these rejections should be withdrawn.

The Office Action also stated that the reference to "opposite" directions in claims 34 and 35 was indefinite because "direction" was not defined. As stated above, claim 27, from which claim 34 depends, and claim 35 have each been amended to explicitly define the term "deposition direction". Accordingly, the term "opposite" deposition direction is definite, and this rejection should be withdrawn.

The term "growing film topography" of claims 21, 27, and 35 was specified in the Office Action to be indefinite. With this amendment, the term "growing" is stricken from these claims, which now recite "a top surface of each of the plurality of layers being characterized by an uneven film topography". This amendment addresses the concerns raised in the Office Action regarding the term "growing". Thus, this rejection should be withdrawn.

Regarding claim 21, the Office Action states that "it is unclear what defines 'ballistic separation' when more than two components are present." Applicant respectfully submits that ballistic separation of more than two components is the same as ballistic separation of two components. For example, three components each simultaneously deposited from a different deposition direction will tend to collect on three different surfaces of the hills in the uneven film topography defining the top surface of each layer. Because this language is not indefinite, this rejection should be withdrawn.

Claims 26 and 32 have been amended to specify a sum of the deposition angles of any two simultaneously-deposited components is in the specified range. This amendment addresses the concern raised in the Office Action that it was uncertain what an angle resulting between two deposition angles would be. Thus, this rejection should be withdrawn.

Regarding claims 28, 29, 36, and 37, the Office Action was correct in noting that the deposition angles, as defined by the claims, cannot be negative. Thus, these claims have each been amended to designate each deposition angle as a positive angle value. This rejection should be withdrawn.

Finally, paragraph 17 of the Office Action finds claims 21-40 indefinite because these claims do not specify whether the claimed deposition steps are limited to vapor deposition method steps. Applicant disagrees that this renders claims 21-40 indefinite. The claimed invention is directed to thin film structures formed by depositing multiple components from multiple directions at angles that depart from the surface normal, i.e., any oblique deposition process. Thus, because the claimed invention is not limited to any specific deposition method, the claims need not specify any particular deposition method, and this rejection should be withdrawn.

Paragraph 18 – Specification

The specification was objected to in the Office Action as failing to provide proper antecedent basis for the claimed subject matter. With this Amendment, claims 21-40 have been amended to more clearly define the invention. In making these amendments, Applicant submits that

the language used to claim the invention is consistent with the language used the specification to describe the invention. See in particular, page 3, line 20 through page 4, line 14.

Paragraphs 22-27 – Anticipation

Paragraphs 22-27 of the Office Action rejected claims 21-40 as being anticipated under 35 U.S.C § 102 by various prior art references. None of this prior art teaches the invention as claimed. Moreover, paragraph 28 of the Office Action admits that the prior art recited in paragraphs 22-25 and 27 does not teach the claimed process limitations. Each of these rejections, and the way by which the claimed invention distinguishes therefrom, is separately addressed below.

Claims 21-40 are each directed to a thin film structure having lateral composition modulations. The thin film structure includes a substrate and a plurality of layers deposited upon the substrate. Each layer is composed of at least two ballistically-separated components. Each of these components is deposited at a deposition angle from a deposition direction different than deposition directions from which each of the remaining components is deposited. Each layer also has a top surface characterized by an uneven film topography having mounds and valleys which result in each of the simultaneously-deposited components tending to accumulate on sides of the mounds different than the sides upon which the remaining components accumulate.

Spontaneously Self-Assembled Structures

Claims 21-40 were rejected as being anticipated under 102(b) by Applicant's admissions at page 2, first two paragraphs; Miricki et al. in MRS Bulletin; and Chambliss et al., U.S. Patent No. 5,858,455, each of which teaches self-assembled structures. Self-assembled structures do not meet the plain language of claims 21-40. Specifically, self-assembled structures fail to meet the claim language requiring that a top surface of each of a plurality of layers have an uneven film topography of mounds and valleys. As described in the specification, this uneven film topography ballistically separates simultaneously-obliquely-deposited components from one another, resulting in a thin film structure having lateral composition modulations. Contrary to self-assembled structures which are limited in application to specific materials having the proper crystal structure to spontaneously arrange themselves, these modulations result regardless of the components

deposited. Additionally, the various components of the final structure are not deposited from different deposition angles. Thus, the structure of claims 21-40 patentably distinguishes from self-assembled structures.

Regarding Chambliss et al., the Office Action states that the simultaneous deposition of two separate components from two different directions is taught therein. Applicant respectfully disagrees. Chambliss et al. relies upon "the spontaneous formation or 'self-assembly' of a giant magnetoresistance multilayer structure of alternating stripes of ferromagnetic and nonferromagnetic metal that are stacked laterally on a special template layer." (Abstract). Nowhere does Chambliss et al. teach that each component should be simultaneously deposited from a different deposition direction. FIG. 5 shows two metals being simultaneously deposited. In describing FIG. 5, Chambliss et al. make no mention of the deposition directions of the two metals, although they do specify the deposition rate and temperature. (Col 5:67-6:4). It is described, and understood by those skilled in the art, that the two metals are not obliquely deposited, but rather, that the lateral composition modulations result because of the careful selection and formation of the substrate and the deposited metals. This self-assembly results regardless of deposition angle. Because Chambliss et al. do not teach the deposition of at least two components from different deposition angles, and for the reasons specified in the previous paragraph, claims 21-40 are patentable over Chambliss et al.

Photolithographically-Patterned Lateral Composition Modulation

The Office Action rejected claims 21-40 as being anticipated under 102(b) by Applicant's admissions at page 1, final paragraph, and Iwatsuka et al., U.S. Patent No. 5,245,471, both of which teach thin films having photolithographically-patterned lateral composition modulations. This type of structure does not meet the plain language of the claims. To make such a structure with two components, a first component is deposited to a thickness desired of the final structure. Next, a photoresist mask is deposited upon the first component to allow for the selective removal of portions of the first component. Finally, a second component is deposited into the removed portions. As known to those skilled in the art, photolithography has strict dimensional

limitations; that is, the positioning tolerance is, at best, about 0.5 microns (or about 5000 Angstroms) and the size of the smallest features allowed is about 1 micron. Differently, the claimed structure will have lateral composition modulations on an atomic scale. Moreover, the photolithographically-patterned structure does not meet the claim language requiring that a top surface of each of a plurality of layers have an uneven film topography of mounds and valleys. Thus, claims 21-40 are patentably distinguishable.

Multi-layered Structures

Claims 21-40 were also rejected under 102(b) as being anticipated by Bertero et al., U.S. Patent No. 5,660,930. Claims 21-40 are directed toward a thin film structure having lateral composition modulations, while Bertero et al. teach a thin film structure having vertical composition modulations; i.e., a plurality of layers. The Office Action admits that the Bertero et al. structure differs from the claimed structure, but suggests that the claimed structure is met by rotating the Bertero et al. structure 90°. Applicant respectfully notes that a thin film structure rotated onto its side is no longer a thin film structure -- that is, its thickness dramatically increases. Additionally, claims 21-40 require that the thin film structure comprise a substrate and a plurality of layers deposited upon the substrate. Each layer comprises at least two ballistically-separated components. The Bertero et al. structure additionally does not meet the claim language because it does not have meet the claim language requiring that a top surface of each of a plurality of layers have an uneven film topography of mounds and valleys. Thus, claims 21-40 patentably distinguish from Bertero et al.

Conclusion

In view of the foregoing remarks, Applicant believes that claims 21-40 are in condition for allowance. Reconsideration and notice to that effect is respectfully requested. The Examiner is invited to contact the undersigned at the telephone number listed below if such a call would in any way facilitate allowance of the application.

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The Commissioner is authorized to charge any additional fees associated with this paper or credit any overpayment to Deposit Account No. 11-0982. A duplicate copy of this communication is enclosed.

Respectfully submitted,

KINNEY & LANGE, P.A.

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